enough to be timed. Two of those which occurred in eastern Mindanao (on March 14 and April 18) were registered all over the world, and were followed by after-shocks too numerous to chronicle. Two other earthquakes (on August 23 and September 4) were also recorded at Formosa and Zikawei.

No. 8 of vol. ii. of the Economic Proceedings of the Royal Dublin Society contains a lecture delivered by Prof. G. T. Morgan before the Royal Dublin Society on "Modern Dyes and Dyeing." This gives an interesting review of the history of modern dyes and synthetic colouring matters. Amongst other matters, it is stated that more than 90 per cent. of the world's demand for indigo is now met by the synthetic product. A recent discovery of great interest is that made by Friedländer, who has shown that the antique dye, "Tyrian Purple," which was extracted by the ancients from several species of sea-snails, found in the Mediterranean, and was highly prized in Italy and Greece, is in reality dibromoindigo.

A VALUABLE contribution to our knowledge of the distribution of radium emanation in the earth's atmosphere is made by Messrs. J. R. Wright and O. F. Smith, of the University of the Philippines, in the February number of the Philippine Journal of Science. Working in Manila and on Mount Pauai at an altitude of 2460 metres, they found by the charcoal absorption method that the average amounts of emanation present during the eight months of observation in terms of its radium equivalent were $82 \times 10^{-12}$ grams at sea-level and $19 \times 10^{-12}$ grams on the mountain. In both cases the ratio of the greatest to the least amount observed was 4 to 1, and the changes were closely related to the weather. Fair weather gave high, and heavy rain low content which was especially low during typhoons. As the authors propose to continue their observations, it is to be hoped that they will attempt to trace the paths traversed by the winds which give the high and low values respectively previous to their arrival at the islands.

WE learn from the *Engineer* for July 24 that work on the reconstruction of the Quebec bridge over the St. Lawrence River is making very satisfactory progress. The entire substructure was completed last season, and the coming season will see considerable progress on the erection of the superstructure. The superstructure is constructed partly of carbon steel and partly of nickel steel, the floor members being constructed of the former, and the truss members of the suspended span, together with the greater part of the cantilever arms, of the latter material. Drawings giving the arrangement and principal dimensions of the superstructure are included in the article. The bridge is designed for 5000 lb. per lineal foot. Wind load is assumed at 30 lb. per square foot of exposed surface of the two trusses and 1·5 times the elevation of the floor, and 300 lb. per lineal foot as a moving load on the exposed surface of the train. In considering temperature stresses, the following conditions were assumed: a variation of 150° F. in the temperature of the whole structure. A difference of 50° F. between the temperature of steel and masonry. A difference of 25° F. between the temperature of a shaded chord and the average temperature of a chord exposed to the sun. A difference of 25° F. between the outer webs exposed to the sun and the inner webs of the compression members.

MESSRS. E. MERCK, of 66 Crutched Friars, London, E.C., have issued a pamphlet containing a list of the Merck chemicals now stocked in London. Considerable additions have been made to the number of articles which are kept regularly in stock, especially as regards "Merck's Guaranteed Reagents." Special labels are attached to the latter, which show the impurities from which these reagents have been shown to be free, when tested according to the well-known Merck standards. The list of stock now includes about 650 articles, and about 900 subdivisions, so that immediate delivery can be guaranteed for all the more important pharmaceutical and analytical preparations.

## OUR ASTRONOMICAL COLUMN.

COMET 1913*f* (DELAVAN).—The ephemeris of Delavan's comet (1913*f*) given below is the continuation of that published by Dr. G. van Biesbroeck in *Astronomische Nachrichten*, No. 4739:—

| | R.A. (true) | | | Decl. (true) | | | Mag. |
|---|---|---|---|---|---|---|---|
| | h. | m. | s. | ° | ′ | ″ | |
| July 30 | 5 | 59 | 6·3 | +38 | 18 | 44·5 | 6·3 |
| 31 | 6 | 2 | 5·4 | | 38 | 41·9 | |
| Aug. 1 | | 5 | 8·2 | | 58 | 45·2 | |
| 2 | | 8 | 14·6 | 39 | 18 | 54·3 | |
| 3 | | 11 | 24·8 | | 39 | 8·6 | 6·2 |
| 4 | | 14 | 39·0 | | 59 | 27·7 | |
| 5 | | 17 | 57·3 | 40 | 19 | 50·9 | |
| 6 | 6 | 21 | 19·9 | +40 | 40 | 17·9 | 6·1 |

The comet is situated in the region about θ Aurigæ.

ASTRONOMICAL NOTES FOR AUGUST, 1914.—The planet Jupiter will be a fine object for observation, being in opposition to the sun on August 10, and visible during the whole night.

The great red spot and hollow in the southern equatorial belt should be observed and the times of their transits across the central meridian of Jupiter taken. These may be expected to occur at the following approximate times:—

| | h. | m. | | h. | m. |
|---|---|---|---|---|---|
| Aug. 8 | 9 | 30 | Aug. 20 | 9 | 23 |
| 10 | 11 | 8 | 22 | 11 | 1 |
| 13 | 8 | 38 | 25 | 8 | 31 |
| 15 | 10 | 16 | 27 | 10 | 9 |
| 17 | 11 | 54 | 29 | 11 | 47 |
| 18 | 7 | 45 | 30 | 7 | 38 |

The spot is now in longitude about 205°. Its accelerated motion since the middle of the year 1914 has caused it to lose 153° of longitude, which represents a westerly drift of about 105,000 miles. The rotation period derived from the motion of the spot was in 1910 equal to 9h. 55m. 37·4s., in 1913 it was 9h. 55m. 35·9s.

THE METEORIC SHOWER OF PERSEIDS.—During the past few years not many of the Perseids have been observed. This year they commenced early, Miss Cook at Stowmarket saw them on July 14. The maximum will probably occur on August 11, but there will also be many meteors on August 12. The moon will somewhat interfere with the success of the observations, as she rises on August 11 at 9.1 p.m., and on August 12 at 9.14 p.m., but she will be nearing third quarter, and her light will therefore not be strong. Observers should ascertain, by counting the horary

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numbers, when the maximum occurs, and the brighter meteors, both Perseids and non-Perseids, should be individually recorded as regards their apparent paths amongst the stars and their durations of flight.

PHOTOMETRIC TESTS OF SPECTROSCOPIC BINARIES.—Mr. Joel Stebbins gives an account of his photometric tests of spectroscopic binaries (*Astrophysical Journal*, vol. xxxix., No. 5), and it is interesting to note that the attempt has been successful. His first experiments were made in 1904, with a visual photometer; but, not succeeding in finding any new variables, he laid the problem aside for a time. The perfection of the selenium photometer has led him to renew the tests and the results are described in his paper. Using a telescope of 12-in. aperture, he has limited himself in the first instance to stars brighter than third magnitude, and arranged his programme of binaries so as to observe them at the proper times. Then he computes from the spectroscopic elements the instants when the longitude from the node is equal to 90° or 270°, and observes at these times. The observations are most difficult because of the exacting requirements, and only work on the very first-class nights is possible. Mr. Stebbins has considered that the most favourable cases for inquiry are the systems of short-period and large range of velocity, or those which have a large value for $m^3_2 \sin^3 i/(m_1+m_2)^2$. So far his observations have led him to discover four eclipsing stars, while seven other stars are considered as constant. The following table summarises his results:—

*Eclipsing Stars.*

| Star | Period *d* | Spectrum | $\frac{m^3_2 \sin^3 i}{(m_1+m_2)^2}$ |
|---|---|---|---|
| β Aurigæ | 3·96 | Ap | 0·54 |
| δ Orionis | 5·73 | Bo | 0·60 |
| α Virginis | 4·01 | B2 | 0·82 |
| α Coronæ | 17·36 | Ao | 0·06 |

*Constant Stars.*

| | | | |
|---|---|---|---|
| α Andromedæ | 96·67 | Ao | 0·18 |
| α Aurigæ | 102·02 | Go | 0·18 |
| ι Orionis | 29·14 | Oe5 | 1·14 |
| $α_1$ Geminorum | 2·93 | Ao | 0·0097 |
| $α_2$ Geminorum | 9·22 | Ao | 0·0015 |
| ζ Ursæ Majoris | 20·54 | Ap | 0·49 |
| β Scorpii | 6·83 | B1 | 1·26 |

LATITUDE VARIATION 1913·0 TO 1914·0.—Prof. Albrecht communicates to the *Astronomische Nachrichten,* No. 4749, provisional results of the International Latitude Service for the period 1913·0 to 1914·0. The information is presented in a form similar to those previously published, and so is familiar to readers of this column. Since 1912 the amplitude of variation has become rapidly reduced. A useful diagram accompanies the communication displaying graphically the track of the pole from 1909·0 to the beginning of the present year.

A CLOSE COMPANION TO η ARGUS.—Mr. R. T. A. Innes publishes in the *Monthly Notices* for June (vol. lxxiv., No. 8, p. 697) some details about the magnitude of η Argus and the discovery of a close companion. The former observations were made as it was reported that this star had become a naked eye object in 1913, but it is shown here that since 1899 the magnitude (7·7 about) has not changed, no variation greater than the errors of estimation being detected. On June 10 Mr. Innes found that η Argus was not a single star, but had a faint companion north following (74°, 1″, mags. about 8·0 and 10·5). Mr. Innes recalls an observation of his made in 1900, when he found the star single, and he refers to Prof. See's unsuccessful search in 1897 for duplicity. Thus he concludes that there is a fair *a priori* probability that the companion is in orbital movement, and suggests that the outbursts of light which have occurred in the past have been caused by periastral grazings. Two other observers corroborated the presence of this companion, and it was further noticed at the same time that η Argus appeared fuzzy, it being impossible to focus this star sharply while neighbouring stars of much the same hue, as well as those both redder and yellower, could be sharply focussed.

## *RELICS OF A LOST CULTURE IN ARIZONA.*

DR. J. WALTER FEWKES gives a detailed and fully-illustrated account of his archæological investigations of the Casa Grande, and in the Upper Verde River and Walnut Creek valleys, Arizona, in the Twenty-eighth Annual Report of the Bureau of American Ethnology, 1906–7 (1912). Immediately after the discovery of Casa Grande by Father Kino in 1694, there arose a legend, which became persistent, that it was one of the halting-places of the Aztec on their way south. There is, however, no evidence to connect the inhabitants of this building with any of the tribes of the Mexican plateau.

The ruins consist of four compounds and several "clan houses." The compounds are surrounded by a rectangular wall and contain numerous buildings; in one there is a large castle-like building, the Casa Grande. The builders evolved two distinct types of architecture: (1) "great houses," with thick walls, apparently constructed by many persons—features which point to these structures as devoted to public purposes; (2) one-room habitations with wattle walls, provided with a central fire-place in the floor, and with a doorway in the middle of one of the long sides. The presence of stone idols (of which many are figured) indicates a well-developed ceremonial system. While the inhabitants possessed effective weapons in the form of spears and bows and arrows, they were essentially agricultural, cultivating fields of maize, and possibly beans, squashes, and the like. They also gathered mesquite beans. They wove various fibres into coloured belts and cloth, and raised cotton. They made basketry and unglazed pottery, which they decorated with symbols. In disposing of their dead they practised both cremation and inhumation.

Dr. Fewkes concludes that the whole drainage system of the Gila river was inhabited by an agricultural people in a homogeneous stage of culture. Throughout this region existed minor divisions of a common stock. The Pima name Hohokam, or Ancients, may be adopted to designate this ancestral stock, to whom may be ascribed the erection of the *casas grandes* on the Gila. These "great houses" were places of refuge, ceremony, and trade. They were inhabited by, and ruled by, chiefs, whose names are known to the present Pima. The people lived in small huts of perishable character, not unlike the Pima *jacales* of historic times. In the course of time a hostile faction bent on pillage came into this region from the east and west and drove the agriculturists out of their *casas grandes,* or, at least, broke up the custom of building such structures. But, although dispersed, the ancient house builders were not exterminated; some of them became refugees and migrated south into Mexico, some followed the course of the Verde and the Tonto into the northern mountains; but others, perhaps the majority, gradually lost their former culture, and remained in the Gila valley, becoming the ancestors of the present Pima, Papago, and Kwahadt (Quahatika). Those who went northward later built pueblos, now in ruins, in the Little Colorado valley. Their descendants ultimately joined

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